NISSMG – Potential Actinide Sealed Source Disposition at WIPP

The Department has various inventories of actinide sealed sources that are currently excess or planned to be excess to programmatic needs by 2015. These sources need to be dispositioned to enhance safety and reduce infrastructure cost of maintaining the source inventory. As a general observation, actinide sealed sources can be categorized by disposition end states, which are:
1) If the material characteristic and activity is sufficiently desirable - reuse or recycle [either direct reuse or as research / development feed stock];
2) If the material item is not sufficiently desirable to merit retention, the material can be declared as a waste and direct disposal as LLW or TRU waste;
3) Stabilization and disposal as HLW; and
4) Interim storage as non-defense TRU waste.
This paper is an estimate of the volume of actinide sealed sources currently managed as nuclear materials that may be disposed at WIPP as TRU waste.

Table 1 provides a breakdown of the actinide sealed source inventory data by isotope utilizing data acquired during the 1998 Nuclear materials integration (NMI) project and currently maintained by the NMSP's NISSMG. The WIPP end state limits individual waste containers (DOT Type 7C) to 200 ci (Pu –239) or 12.4 FGE. For this estimate Table 1 is divided by isotope and further subdivided into three distinct categories: (1 – number of items that meet or exceed the ^{239}Pu Fissile Gram Equivalents {FGEs}per 55 gal drum; (2 – number of items that contain 1-12.4 curies; and (3 – number of items less than 1 curie.

Pu-239 > 12.4	Total Ci
10	538.937
Pu-239 >1	
62	148.706
Pu-239 <1	
5164	40.77
Pu-239 Total	
5247	728.413

Pu-238 > 12.4	Total Ci
108	16435.83
Pu-238 > 1	
195	533.3385
Pu-238 < 1	
234	3.01
Pu-238 Total	
428	16972.18

Am-241 > 12.4	Total Ci
2	130.267
Am-241 > 1	
32	116.066
Am-241 < 1	
1750	18.93
Am-241 Total	
1784	265.263

Am-243 > 12.4	Total Ci
0	0
Am-243 > 1	
1	1.198
Am-243 < 1	
50	1.71
Am-243 Total	
51	2.908

Discussion by Isotope

^{239}Plutoium

There are 10 items (LBNL,INEEL,SRS, & RFETS) larger than the allowable 12.4 ci FGE limit per 55 gal drum in the NISSMG inventory, four of these items also exceed the 20.15 ci FGE limit per standard waste box limit. All 10 items hence can not be disposed at WIPP unless there is some degree of processing performed to further subdivide the activity per drum. For the four large sealed sources disposal as part of the "can in can" program at SRS appears to be the most logical solution when these sources become excess to current program needs. The remaining six items are candidates for WIPP, but could also be included in the "can in can" program. Reuse as MOX feed due to the high purity of the materials is a possible option for all these materials.

There are 62 items in the NISSMG inventory are between 1 – 12.4 curies, of these 21 likely do not have a defense program pedigree. The remaining 41 items are potential candidates for WIPP disposal. Using the 12.4 curie FGE limit per 55 gal drum and taking no credit for consolidation this equates to only 41 additional 55 gal barrels.

Of the remaining 5175 items (40.77 curies) represented in the NISSMG inventory, a large fraction 93% are LLW candidates.

The worst case scenario for the number of shipments to WIPP assuming there are no economies for "centralized consolidation" and including non-defense, TRU is presented in Table 2.

^{239}Pu	55 Gal Drum	Standard Waste Box
Items greater than 12.4 curies	37	6
Items greater than 1 curies and less than 12.4 curies	62	0
Items less than 1curie (assumes consolidation on shipping site)	45	0

If the total inventory of NISSMG ^{239}Pu inventory (~728 ci) is compared to the 795,000 curies that is included in the WIPP performance assessment, the obvious conclusion is the ^{239}Pu will not have a significant impact.

^{241}Americium

There are 2 items larger than the allowable 12.4 ci FGE limit per 55 gal drum in the NISSMG inventory. One of these has 18.6662 curies of activity and could be disposed as TRU waste in a standard waste box. The other has over 117 curies, making it a difficult item to dispose at WIPP without repackaging. Logical pathways include the "can in can" SRS process or due to the high purity of the material reuse as feed material for commercial neutron or actinide sources.

There are 32 items in the NISSMG inventory are between 1 – 12.4 curies, of these 14 likely do not have a defense program pedigree. The remaining 18 items are potential candidates for WIPP disposal. Using the 12.4 curie FGE limit per 55 gal drum and taking no credit for consolidation this equates to only 18 additional 55 gal barrels.

Of the remaining 1750 items (18.93 curies) represented in the NISSMG inventory, a large fraction 76% are LLW candidates.

The worst case scenario for the number of shipments to WIPP assuming there are no economies for "centralized consolidation" and including non-defense TRU, is presented in Table 3.

^{241}Am	55 Gal Drum	Standard Waste Box
Items greater than 12.4 curies	10	1
Items greater than 1 curies and less than 12.4 curies	32	0
Items less than 1curie (assumes consolidation on shipping site)	51	0

If the total inventory of NISSMG ^{241}Am inventory (~18.93 ci) is compared to the 488,000 curies that is included in the WIPP performance assessment, the obvious conclusion is the ^{239}Pu will not have a significant impact.

^{238}Plutoium

There are 428 items in the NISSMG inventory, 108 of these are larger than 12.4 curies and 195 items are between 1 – 12.4 curies and contain 16,969 curies of activity. Recycle options exist for all of these items, LANL and ORNL are both actively pursuing any excess ^{238}Pu for use in the future NE missions.

The remaining 234 items have 3.01 curies of activity and 86% are likely candidates for LLW disposal. The remaining 37 items have 3.00 curies of activity.

The worst case scenario for the number of shipments to WIPP assuming there are no economies for "centralized consolidation" and including non-defense TRU, is presented in Table 4.

^{238}Pu	55 Gal Drum	Standard Waste Box
Items greater than 12.4 curies	0	0
Items greater than 1 curies and less than 12.4 curies	0	0
Items less than 1curie (assumes consolidation on shipping site)	27	0

^{243}Americium

There are no items larger than 12.4 curies in the NISSMG inventory and there is only one item between 1 – 12.4 curies and it likely has no defense pedigree. The remaining 50 items only have 1.71 curies of activity. Generally, the isotope production program at ORNL is willing to take all ^{243}Am for reuse as feed materials to their isotope production program.

The worst case scenario for the number of shipments to WIPP assuming there are no economies for "centralized consolidation" and including non-defense TRU, is presented in Table 5.

^{243}Am	55 Gal Drum	Standard Waste Box
Items greater than 12.4 curies	0	0
Items greater than 1 curies and less than 12.4 curies	1	0
Items less than 1curie (assumes consolidation on shipping site)	9	0

Conclusions

Even though there are 7510 sealed neutron sources actinide sources in the NISSMG inventory, this doesn't represent at large number of 55 gal drums or a significant increase in the total amount of activity permitted in the WIPP performance assessment. The worst case estimate of drums resulting from neutron and actinide sources is 274 drums and 7 waste boxes.

Planned Future Activities

If Goal 3: Optimize TRU waste system operations, item 3. "Identify and evaluate alternatives to current treatment, characterization, transportation and disposal issues (e.g., centralized disposal characterization at WIPP)" of the "National TRU Waste Management Plan, DOE/NTP 96-1204, Revision 2" is implemented these estimates can be greatly reduced.

Defense TRU versus Non-defense TRU

Approximately 30% of the ^{239}Pu and ^{238}Pu sealed sources in the NISSMG inventory likely do not have a defense programs legacy. About 20% of the ^{241}Am and 30% of the ^{243}Am appear to not have a defense programs legacy.